THE AUSTRALIAN ZOOLOGIST
VOLUME 19 1976 PART I

Studies of an Island Population of *Antechinus minimus* (Marsupialia, Dasyuridae)

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ABSTRACT

Field studies including a grid trapping and mark, release, recapture programme, of an island population of *Antechinus minimus* indicated that population density was exceptionally high (80 individuals per hectare). Males were significantly more mobile than females. Although the sequence of life history events closely corresponds to that of most other members of the genus, the timing of breeding is 2-3 months earlier than in the other south-east Australian species. An hypothesis for this reproductive phase difference is put forward.

INTRODUCTION

Of the four south-east Australian species of the dasyurid marsupial genus *Antechinus, A. minimus* (the swamp phascogale) is the least common and most restricted in distribution. The mainland subspecies *A. minimus maritimus* seems to be limited to a few scattered coastal localities from Robe in South Australia to Wilson's Promontory in Victoria (Wakefield and Warneke, 1963, 1967) and the Casterton district in western Victoria.

The only member of the genus on which there is much recent literature is *A. stuartii,* a common eastern Australian species (Barnett, 1973, 1974; Braithwaite, 1973, 1974; Marlow, 1961; Wood, 1970; Woollard, 1971; Woolley, 1966). Most work on *A. minimus* has been taxonomic (Finlayson, 1958; Tate, 1947; Wakefield and Warneke, 1963) although Green (1972) supplied notes on some broader aspects, including field observations, of the Tasmanian and Bass Strait islands nominate form.

The present paper reports on some findings, principally concerning population density and reproductive biology, of a field study of an insular population of *A. minimus.*

MATERIALS AND METHODS

1. Study Area

Field work was carried out on Great Glennie Island, an island in Bass Strait about 6 km west of Wilson's Promontory. The island is elongate (N-S), about 2.5 km long, with an area of approximately 66 hectares (160 acres). The study area was on a northern slope in the Glennie Cove region at an altitude below 50 m.

The parent material is a grey, coarse-grained granite which is locally weathered with the development of coarse, sandy and often humus-rich soil.

Being a relatively small unprotected land mass, Glennie Island has a uniform maritime macroclimate. It is assumed that weather conditions are comparable with those of the nearest Bureau of Meteorology weather station, the Lighthouse at South-East Point, Wilson's Promontory, at an altitude of 100 m (see Bureau of Meteorology, 1969).

The vegetation of the study area is relatively uniform in character and typical of vegetation of much of the island. In the more rocky and sheltered situations there is a closed heath structural formation to a height of about 2 m. The upper stratum of dominant plants consists of a diversity of shrubs including silver banksia (*Banksia marginata*), coast tea tree (*Leptospermum laevigatum*), white correa (*Correa alba*), dusty daisy bush (*Olearia phloggopappa*) and common boobialla (*Myoporum insulare*). There is usually an understorey of *Poa* tussocks, the density of which appears to depend upon the intensity of light penetrating the shrub layer. In exposed areas where soil is often humus-rich and moderately deep, tussock grassland of the blue tussock grass (*Poa poiformis*) predominates, often interspersed with small shrubs, especially hoary sunray (*Helipterum albicans*), and many low succulent herbs including bower spinach (*Tetragonia implexicoma*), saloop (*Rhagodia hastata*) and rounded noon-flower (*Disphyma australe*).

2. Field Technique

Three visits to Glennie Island in 1975 took place in April, May and September. For the collection of data on movement, home range and population density a programme of grid live-trapping was undertaken, using aluminium Elliott Type B traps (32 cm x 9 cm x 9 cm). A rectangular grid of five columns and six rows (30 stations) was layed out with adjacent trap stations placed 10 m apart. Since many *Rattus fuscipes* also entered the traps, three traps were placed at each station.

3. Movements and Population Density

As some individuals from outside the periphery of the grid entered traps it was necessary to estimate the effective area trapped to calculate abundance of *A.*

minimus. The measure used was the average distance moved between successive captures (Av.D.), which was shown by Brant (1962) to be a good measure of the width of the boundary strip around the grid from which individuals were trapped. Av.D. was calculated for each recaptured animal and mean values for males, females and the population were obtained.

To estimate the number of animals in the effective area trapped a mark, release, recapture programme was conducted. The grid was trapped on three nights in May when animals were marked by toe-clipping and released at the site of capture.

RESULTS

1. Trapping Success

(a) General

A total of 65 individual *A. minimus* (33 ♂, 32 ♀) was trapped at Glennie Island in the 1500 trap-nights of the study. Of these, 15 (10♂, 5♀) were recaptured in a later trapping session. There were 74 recaptures in all with from one to seven recaptures per individual. With a total of 152 captures the overall trapping efficiency was 10%/trap-night. Trapping efficiency in May was 23%/trap-night.

(b) Grid Trapping

Over the three nights of grid trapping 34 animals (22♂, 12♀) were captured, with a total of 99 captures (74♂, 25♀). The average number of captures per male was 3.36 and per female was 2.08. Therefore the ratio of males to females captured was 1.62.

2. Movement

The mean Av.D. values for the 16 males and 7 females trapped more than once on the grid were 19.3 m and 13.4 m respectively. These values are significantly different at the 95% probability level. The Av.D. for the population was 16.4 m.

3. Density Estimate

Table 1 shows grid recapture trapping results. The three Lincoln Index (Lincoln, 1930) estimates of population size between trapping nights 1 and 2, 1 and 3, and 2 and 3 are 42, 26 and 34 respectively. The population size calculated using Hayne's method (Hayne, 1949) is 36, the value used for the density estimate. Using 15 m as an approximately minimum value of Av.D. and diameter of the boundary strip, the area of effective trapping was 0.45 hectares (1.1 acres). The population density was therefore 80 individuals per hectare (32 per acre).

TABLE 1

Recapture trapping results of *A. minimus* on the grid at Glennie Cove, May, 1975.

Night	Number of animals trapped			Number of animals recaptured		
	♂	♀	Total	♂	♀	Total
May 24th	18	5	23	—	—	—
May 25th	15	9	24	11	2	13
May 27th	16	7	23	16	7	23

4. Reproduction

(a) Sex Ratio

The sex ratio of males to females in April was 1.73:1 (19♂, 11♀) and in May was 1.50:1 (24♂, 16♀). The preponderance of males is probably partly due to their greater mobility. The total number of each sex trapped (33♂, 32♀) gives a false idea of the overall sex ratio since the September trapping session took place after the postmating male die-off.

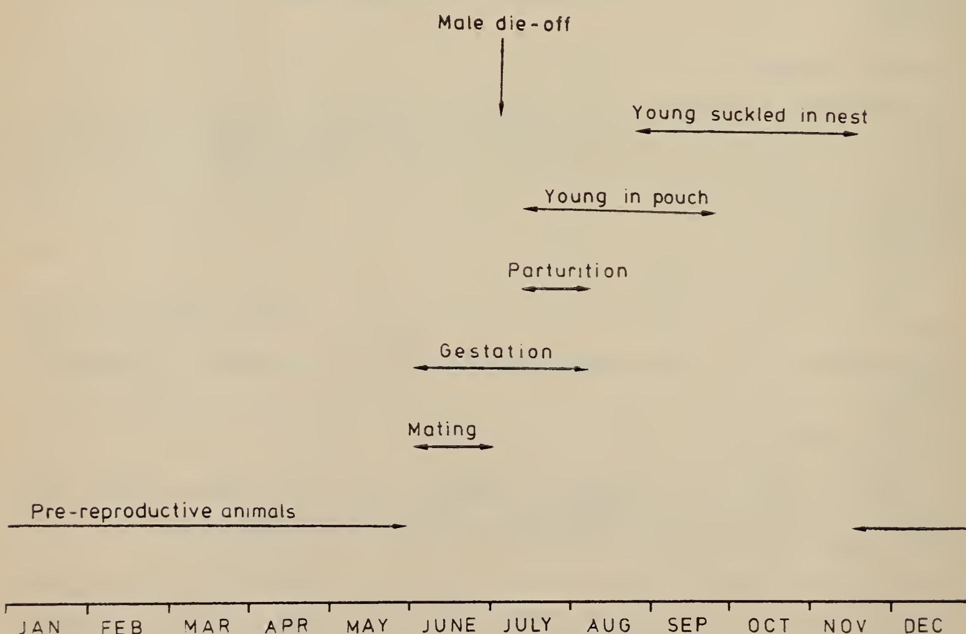

Fig. 1. Timing of life history events of *A. minimus* at Glennie Island.

(b) Life Cycle

An estimate of the timing of the important features of reproduction at Glennie Island is shown in Fig. 1. In late May, mating was occurring. Most parturitions occurred in July and the neonates remained in the pouch until late August to mid September. In early September some females had nest-young and others still had pouch-young. Young were then suckled in the nest until mid or late November; in early November 1975 no juveniles were found, whereas in early December 1974 they were abundant (Barnett, pers. comm.). Although conclusive evidence is wanting, the male die-off, which is universal, probably occurs early in July, because in late July 1973 only females with pouch young were present (Robinson, pers. comm.). No second-year females were encountered.

(c) Litter Size

Of the 10 females captured in September three had pouch-young, the litter sizes being 6, 8 and 8. All females examined possessed 8 teats. The number of well developed nipples of females with nest-young is a reliable indication of the number of nest-young (Woolley, pers. comm.), and the five females with nest-young had 6, 7, 8, 8 and 8 well developed nipples; therefore the average number of young per mother for the 8 females with young was 7.4. The remaining two of the 10 animals captured had not bred.

DISCUSSION

Trapping Success

The trapping efficiency values at Glennie Island of 10%/trap-night overall, and 23%/trap-night during winter, when trapping is most productive, are much higher than values obtained elsewhere. At the Parker River Inlet, Otway Ranges, Vic., in November when juveniles were mobile, a trapping efficiency of 3.6% was obtained (Norris, pers. comm.), and Green (1972) found an efficiency of approximately 2.5% for Tasmanian populations in the most suitable habitat in winter.

Movements and Population Density

Close trap spacing gives capture points too close to disclose the true home range (Chitty, 1937; Stickel, 1954). All or nearly all of the animals on the grid were trapped on the first two nights of the grid trapping programme, suggesting that the area was saturated by traps. Thus Av.D. was kept at a minimum, giving underestimates of the effective area of trapping. Nevertheless, the Av.D. values for males and females, 19 m and 13 m respectively, are 50%-70% those found by Wood (1970) and closer to those found by Braithwaite (1973), both for *A. stuartii*.

Mobility of males was found to be significantly greater than that of females. possibly because males were actively defending territories at this time.

Reproduction

Breeding is restricted to winter, conforming with the limited information available on Tasmanian individuals (Green, 1972). As in the three other south-east Australian species of *Antechinus* (Wakefield and Warneke, 1963, 1967; Woolley, 1973), *A. minimus* appears to be monoestrous. Males and females are sexually quiescent except during the very limited breeding season. There is a total postmating mortality of males, a phenomenon which Lee *et al.* (in press) have investigated in *A. stuartii.*

Breeding is 2-3 months earlier than in *A. stuartii,* in which mating occurs in late August in southern Victoria (Lee *et al.,* in press). This difference in timing may be related to their habitats and availability of food. *A. stuartii* shows extensive arboreal activity (Wood, 1970) and probably hunts for much of its food, consisting of invertebrates including adult insects, on the trunks of trees. Thus it synchronises its breeding with the spring flush of insects. On the other hand *A. minimus* is terrestrial and a large part of its diet consists of larval insects from the soil as well as other terrestrial arthropods (Wainer, 1975). In spring and early summer when *A. stuartii* females are rearing young, and as a result probably require relatively more food, adult insects are at a peak of abundance; however *A. minimus* appears to synchronise its breeding with the peak of larval insects in winter.

In the Glennie Island population no parous second year females, which can be distinguished from virgin females on the basis of development of nipples (Woolley, 1966), were found. The situation in *A. minimus,* therefore, may differ from that in *A. stuartii* where some females survive to a second breeding season (Wood, 1970).

ACKNOWLEDGEMENTS

The National Parks Service of Victoria kindly granted permission to conduct a live-trapping programme at Glennie Island and their co-operation is gratefully acknowledged. Also I wish to express my gratitude to Dr. Angus Martin and Mr. Stephen Morton for reading and commenting on the manuscript, and to Dr. Martin for supervising the project.

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